Chapter 2: Historical Context for the Seacoast Fortifications of San Francisco Bay

Prelude

The subject of seacoast fortifications of the United States has been a remarkably consistent and powerful component of the nation's military policy throughout nearly its entire history. Indeed the American interest in the subject "was to grow virtually into an obsession," according to a leading military historian. [1] The enduring emphasis on seacoast fortifications is based in part on geography and in part on fundamental political convictions about America's place in the world and the nature of our government. Throughout American history, investment in generations of coast defense weapon systems has reflected a faith in technological solutions to problems, a consensus that it is better to spend resources and wealth than sacrifice American lives, and a practical solution to the challenge of national defense that did not require a large standing army and could not be diverted for use as an instrument of internal suppression. A noted military officer recognized before the Civil War that:

> When once constructed they require but little for their support. In time of peace they withdraw no valuable citizen from the useful occupations of life. Of themselves they can never exert an influence dangerous to public liberty, but as the means of preserving peace, and as obstacles to an invader, their influence and power are immense.[2]

The influential Board of Engineers for Fortifications put it thus in the nation's first strategic deterrent analysis prepared by American-developed, not foreign-sponsored, military thinkers after the War of 1812:

> The means of defense for the seaboard of the United States, constituting a system, may be classed as follows: First, a navy; second, fortifications; third, interior communications by land and water; fourth, a regular army and well-organized militia.
>
> The navy must be provided with suitable establishments for construction and repair, stations, harbors of rendezvous, and ports of refuge, all secured by fortifications, defended by regular troops and militia, and supplied with men and materials by the lines of intercommunication Being the only species of offensive force compatible with our political institutions, it will then be prepared to act the great part which its early achievements have promised, and to which its high destiny will lead.[3]

Beginning with the Board of Engineers for Fortifications in 1816 and continuing until the elimination of the Coast Artillery Corps in 1950, a series of high-level boards has examined the nature of the nation's defense strategy, providing national policy and systematic defense programs which resulted in a nationally-significant fortification networks, which reflects the constant evolution of military technology and strategic circumstances. The Board of Engineers quoted above would have found much it could recognize in the basic strategic principles of the nation's Cold War defensive systems: navy carrier groups; Nike missiles and the Strategic Defense Initiative; the interstate highway system for interior communications; and the constant low-level state of mobilization of a professional army and a National Guard and peace-time draft.

The more purely strategic, as opposed to political, considerations upon which this nation's defense policy is based have remained relatively stable due to the nature of geography. This has long been a seafaring nation and our greatest potential enemies have generally been located overseas.

> Throughout most of its history, the United States, separated from the other powerful nations of the world by large bodies of water, relied on coast defense to deter enemy invasion. This defensive measure depended on fortifications but also included submarine mines, nets, and booms; ships; and airplanes. Thus, all of the country's armed forces

participated in coast defense, but the U.S. Army Corps of Engineers played a central role.[4]

Consequently the United States was free to choose an isolationist policy as long as coast defense, coordinated with command of the seas, and more recently the skies, allowed us to effectively defend our shores. Classic coastal fortifications have been obsolete since World War II, but the nation's role as a world power has been backed up by continental defenses based on many of the same basic principles. This military policy has been informed by political, strategic and technical factors that have evolved through time yet also retain a remarkable degree of consistency. Indeed, few principles have been as long-lasting as the dominance of naval ships by land-based fortifications. The key role coastline and hemispheric defense strategy has played in that policy, is reflected today in the successive generations of coast defense fortifications that have evolved and that survive as a tangible manifestation of our historic conceptions of military preparedness.

The Significance of the Seacoast Fortifications of San Francisco Bay

In an early study of fortifications entitled *A History of San Francisco Harbor Defense Installations: Forts Baker, Barry, Cronkhite, and Funston*, noted military historian E.R. Lewis said that "the batteries to be described should be understood to constitute an excellent sample not only of the Bay Area defensive system as a whole, but of the entire scope of American fortifications during this era. While similar works were located in varying numbers on the Presidio, and Forts Mason, McDowell and Miley, Forts Baker and Barry represented, by 1905, one of the two or three best collections of modern coast defense batteries to be found on any single military tract in the United States."[5] The subsequent, broader historic resource study by historian Erwin N. Thompson entitled *Seacoast Fortifications: San Francisco Harbor, Golden Gate National Recreation Area*, expands this concept to all of the San Francisco Bay seacoast defenses. They are nationally significant as an entire system: one that contains many individual elements that are themselves nationally significant.[6] Their only possible rival as an extensive outdoor military museum are those which protect New York harbor, but those around San Francisco faced a different ocean replete with threats from different potential enemies, often at different times from those faced by the New York harbor defenses. In other words, the entire historic context was different on the Pacific shores (Plate 9).

The significance of the seacoast fortifications of San Francisco Bay structures as a group is of the highest order. Therefore, the seacoast fortifications of San Francisco Bay, as described chronologically in the following historical context, are believed to possess exceptional value in illustrating the heritage of the United States: because of their association with events that have made a significant contribution to, are identified with, and outstandingly represent, broad national patterns of United States history; because of their important associations with lives of persons nationally significant in the history of the United States; because they embody the distinguishing characteristics of military fortification architecture and engineering that are exceptionally valuable for the study of an extraordinary range of periods, styles, and methods of construction. even when some individual components may lack distinction; because they collectively compose an entity of exceptional historical significance and outstandingly illustrate military culture and technique; and because areas within the fortification system are likely to yield information that sheds light upon the military period of occupation of these lands.

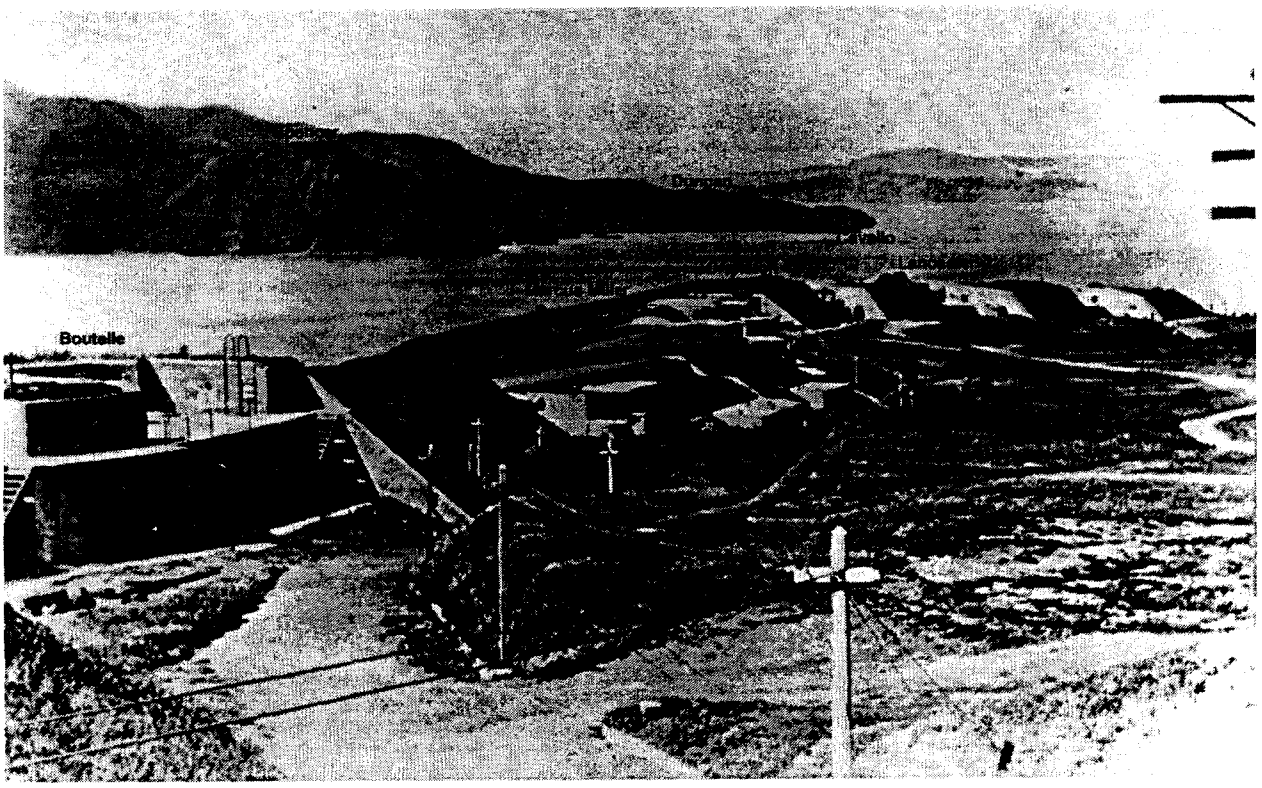

Plate 9. Foreground, from left to right, Batteries Boutelle (constructed 1898-1901), Marcus Miller (constructed 1891-1898), Cranston (constructed 1897-1898), and Lancaster (constructed 1896-1899), Fort Winfield Scott. Background, from left to right, Batteries Spencer (constructed 1893-1897), Duncan (constructed 1898-1899), and Cavallo (constructed 1872-1876), Fort Baker. Looking north, circa 1910. Courtesy of the Park Archives of the Golden Gate National Recreation Area.

The Spanish Colonial and Mexican Era, 1794-1846

The earliest permanent seacoast defense works in the country are associated with the colonial empires in North America. All the major colonial and seafaring powers provided some protection to the most important ports with varying degrees of success and permanence. The *Castillo de San Marcos* was begun in the Spanish colony of Florida in 1672 and Castle William in Boston around 1700. Scattered, less permanent, batteries guarded anchorages from British Rhode Island to Spanish Alta California.

Compared with its ascendancy under the name of San Francisco in the arena of world commerce and trade, the outpost of Yerba Buena, on San Francisco Bay, was a relatively unimportant settlement. Yet within the context of Spanish colonial and Mexican heritage in the United States the fortifications of San Francisco Bay were significant because they protected the claim of the Spanish crown to the northernmost permanent outpost of its empire on the shores of the Pacific Ocean. It was during this era that the potential of the vast harbor of St. Francis was first recognized, and its fortification first begun.

The establishment of a military frontier outpost to physically assert Spanish hegemony over San Francisco Bay dates to the fall of 1776. However, this outpost, or presidio, was a protected garrison that can in no way be regarded as a seacoast fortification. In light of diplomatic agreements reached at the Nookta Convention of 1790, British and Russian influence in the Pacific basin was reluctantly conceded by the Spaniards. Two years later, the British naval officer George Vancouver visited the Presidio of San Francisco, and apprised his government of the total lack of defenses there. In response to this visit, Governor Jose Arrillaga ordered fortifications begun to protect the strategic harbor.

As a result, works were begun in 1793 on a land battery to protect the Bay of San Francisco at its narrow entrance. Located on *La Punta de Cantil Blanco*, or the point of the white bluff overlooking the two-mile wide channel from the south, a brick-faced adobe lozenge with 15 embrasures surrounding a wooden esplanade, was completed in December of 1794 and christened the *Castillo de San Joaquin*. (The site is identical to that of the present fort at Fort Point.) The castillo was only intermittently manned by soldiers from the nearby Presidio, and in spite of subsequent reconstruction attempts (in the shape of a horseshoe), quickly fell victim to rain, a shifting sand substrate, and lack of adequate upkeep. Because of the construction of the fort at Fort Point at the site, nothing remains of castillo today. However, six bronze cannon, once a part of its armament, still remain in various locations about the Presidio of San Francisco and Fort Point National Historic Site. Another cannon from the castillo now resides at the U.S. Naval Academy at Annapolis, where it was brought by Commander Jonathan B. Montgomery along with other trophy guns from California after the Mexican War. Some already more than 160 years old when delivered to the Presidio by the Spanish frigate *Aranzazu* in 1794, these cannon, cast in Peru between 1628 and 1693, are among the oldest dated artillery pieces in the United States.

Not long after the establishment of the castillo at *La Punta de la Cantil Blanco*, Spain's relations further soured with Britain, and Spain and Britain went to war in 1797. When it finally reached this remote border settlement, the news galvanized Governor Diego de Borica to order an additional battery built two miles to the east of the castillo, well inside the bay at a point where a convenient anchorage sheltered the installation under the lee of a commanding bluff (at the site of present-day Fort Mason). Called *La Batteria Yerba Buena* after the name of the cove, or *La Batteria San Jose*, this work was even more of an emergency structure than was the castillo. These earthworks were built with eight embrasures, although only five iron eight-pounders are thought to have been placed at the site. An account written in 1822, about the time Alta (or upper) California passed quietly to Mexican authority, recalled only one rusty cannon at the derelict battery. By 1846 the site was entirely abandoned. No traces of this work are known to exist today.

During the period of Mexican rule, increasing seaborne trade in hide and tallow, and an expanding influx of Anglo-American settlers resulted in the territorial ambitions of the young United States becoming focused upon California. By the mid 1840s unrest, intrigue, invasion, and annexation became the lot of Alta California. Lieutenant John C. Fremont, U.S. Army Corps of Topographical Engineers; mountain man Christopher "Kit" Carson; and others, allied themselves to the group of rebels known as the Bear Flag party, and journeyed from Sonoma Barracks towards Yerba Buena, skirmishing on the way. They crossed the harbor entrance (soon to be christened by Fremont himself the Golden Gate) in a small craft to the site of the old castillo at Fort Point. There, they spiked the cannon lying derelict in the ruined work, to prevent their future use. The remains of one of these historic spikes can still be found in the touchhole of the western cannon, named *La Birgen de Barbaneda*, now flanking the flagstaff at the main parade ground of the Presidio of San Francisco.

The transition of seacoast defense weaponry from the Spanish-Mexican era to the United States may be symbolized by the arrival in San Francisco Bay of the U.S. frigate *Portsmouth*, under the command Commander Montgomery. Her crew landed at the Yerba Buena shoreline, proceeded to the plaza, and raised the American flag on 9 July 1846. Marching overland from the settlement, Montgomery's sailors and Marines, went to the site of the Bear Flagger's adventure, and there retrieved five of the six bronze cannon. They were put to use at Clark's Point, in a temporary battery built to overlook the north part of Yerba Buena Cove, the shallow bay at the foot of the town (not to be confused with the Yerba Buena anchorage, near Fort Mason further to the west, soon to be known by the Americans as Black Point Cove). No traces of the Clark's Point battery are believed to exist, the cliffs having been cut back to allow development at the foot of San Francisco's Telegraph Hill.

Third System Fortifications, 1850-1861

The United States had only an uncoordinated collection of local fortifications and no permanent system of seacoast fortifications until Congress made the first appropriations for the purpose in 1794, in reaction to the increased threat of war with European powers. The fortifications that followed are collectively referred to as the first system of American seacoast fortification, and were constructed in relatively small numbers at sixteen commanding locations guarding the ports, naval shore establishments, and harbor entrances along the eastern seaboard. Although a few substantial works were constructed incorporating stone, such as Fort McHenry at Baltimore and Fort Mifflin near Philadelphia, fortifications consisted largely of barbette gun batteries emplaced for protection behind open works with walls of earth, wood and stone. When the threat of war with France receded, the defensive works began to fall into neglect and disrepair in the absence of ongoing garrison and maintenance.

History repeated itself in 1807 when the Congress again appropriated funds for the upgrading of seacoast fortifications in the wake of impressment of American seamen and the threat of war with Britain. This, second system of seacoast fortification, was most notably characterized by the construction of all-masonry forts mounting guns in multiple tiers of casemates, allowing high concentrations of fire. These brick and stone forts were supplemented by an array of barbette batteries at other locations along the eastern seaboard and Gulf Coast. Their development marks the first major manifestation of a strictly American capability for military engineering that followed from the recent establishment of the Military Academy at West Point. The national defense was sorely tested and found wanting during the War of 1812 as British seapower was able to land substantial invasion forces of regular troops in undefended localities in spite of generally effective resistance from fixed defenses. Indeed, the stand of Fort McHenry inspired Frances Scott Key to write *The Star Spangled Banner*, but British regulars were still able to conquer and burn the nation's capital in 1814.

A thoughtful reassessment of the fundamentals of the nation's defense policy unfolded in the relatively peaceful climate of the years that followed the War of 1812. Fixed coast fortifications more than held their own against direct challenge, yet they were successfully outflanked by landings supported by the dominant seapower of the Royal Navy. Once established ashore, the American field armies had mixed success in coping enemy land forces in battle. Although isolated successes of U.S. warships on the high seas won renown, the role of the U.S. Navy remained tied to the defense of coastal waters for most of the century.

In 1816, the Board on Fortifications was established under the leadership of a French fortification expert of the Napoleonic Wars, Simon Bernard, to advise on defense policy and recommend modern projects in the light of recent wartime lessons. Sometimes called the Bernard Board, the establishment of this body of officers marks the nation's first permanent institution devoted to codifying a strategic doctrine and building the infrastructure of a unified defense network.

The system of fortifications that evolved from the work of the Board of Engineers in the period from 1816 to 1860 was the most comprehensive, most uniform, and most advanced the nation had yet had. The third system rationally assigned priorities for a work program to fortify numerous strategic sites. This program is best represented by large brick or stone forts with multiple tiers of gun batteries, in some cases three and four tiers high, built on promontories and on islands at choke points to important harbor entrances.

> It was among the principal forts of the Third System, however, that some of the most spectacular harbor defense structures to come out of any era of military architecture were to be found. Included by virtue of their role in the Civil War were certainly some of the most famous—Sumter, Pulaski, Monroe, Pickens, Morgan and Jackson. From the technical standpoint, this large group of massive, vertical-walled forts represented the general embodiment and the fullest development of features which had previously

appeared in only a few and isolated instances, i.e., structural durability, a high concentration of armament, and enormous overall firepower.[7]

The forts were armed by specialized seacoast artillery of relatively standardized type: it was the beginning of standardized armament systems for U.S. coast defense artillery. They incorporated defensive innovations, such as improved firing embrasures which allowed a great deal of lateral traverse from a smaller, iron-shuttered opening. The sites protected the nation's most vital naval bases, commercial ports and strategic anchorages. When these installations were completed the United States had a true system of coast defense for the first time: it encompassed all three coasts, and it was second to none in the world. Of the more than thirty forts of the third system, begun after 1816, nearly all remain extant, and although a number have been partially altered by the superimposition of later works, the majority in their original form constitute the oldest surviving body of major military structures in the United States.[8]

In March of 1847, U.S. troops occupied the Presidio, based on the temporary ruling of military authorities that the government of the United States assumed the title of all public lands formerly reserved by Mexico—a ruling that encompassed islands in the bay such as Angel, Alcatraz, and Yerba Buena, as well as the former Spanish Presidio. The military governor, Colonel Richard B. Mason, further defined the reserved lands with respect to the boundaries of the Presidio and an area around Point San Jose (now Fort Mason). President Millard Fillmore substantially approved Mason's decisions on 6 November 1850, and added areas at Benicia, Mare Island, and a reservation "from the southern boundary of Sau Salito Bay, a line parallel to the channel of entrance to the Pacific" which became the Lime Point Military Reservation. A further presidential order, on 31 December 1851, refined the boundaries of the Presidio of San Francisco, and established the boundary of the reserve at Point San Jose as an arc 800 yards from its extreme point. With these strokes, the land that encompasses the bulk of today's historic fortifications was acquired. And by this time, the discovery of gold in California gave dramatic new urgency to plans to fortify portions of these reserves.

A Joint Commission for the Defense of the Pacific Coast was established in 1849, and visited the area that same year. Although beset by difficulties in securing reliable manpower and adequate material support, typical of those experienced by many in gold rush California, the Commission eventually completed a survey of the San Francisco Bay Area in 1850 which recommended that it be protected in a manner fitting the most important region on the Pacific Coast.

Among the Joint Commission's specific conclusions were the necessity of "strong works near Fort point on the south side of the channel and also on the north side of the channel nearly opposite to Fort point...batteries at point [San] Jose and on Alcatrazos Island would cooperate with the exterior works and altho' as auxiliaries they may be regarded as of secondary importance, the value of the latter is far greater than that of the former and nearly equal to that of the works at Fort point and opposite to it. A temporary battery on Angel island opposite Alcatrazos would cooperate with the latter..."[9]

The tactical rationale behind this proposal (commonly referred to as the Plan of 1850) was to guard choke points with batteries close to water level in order to bring grazing fire from opposite flanks to bear simultaneously on vessels attempting to run past. Such fire was particularly effective for two reasons. First, vessels could not hug the far shore of a channel in order to increase their distance from the defenses without bringing themselves nearer to fire from the opposite direction. Second, grazing fire was more accurate because flat trajectory fire, skipping along the water surface, had only to be accurate in deflection and not in range. Since attacking vessels obviously benefited by exposing themselves to fire as briefly as possible, local conditions encouraged a full speed dash with both the strong incoming tide and the prevailing northwest winds combining to boost effective speed past the defenses. The proposed works on Alcatraz neutralized such a maneuver, since such vessels would unavoidably head straight at Alcatraz and present a steadily approaching target hardly moving in deflection. The works on Point San Jose and on Angel Island would similarly provide the benefits of cross fire at the locations where channels lead toward the San Francisco waterfront and towards the Benicia Arsenal and Mare Island.

The placement of this first generation of fortifications at San Francisco Bay reflected the limited range (about two miles) and accuracy of the ordnance of the time, which necessitated the close-in defense of key points from within the bay itself and at its immediate entrance. It was prophetically noted by the Joint Commission that these works could be expected to cost four times as much as similar works built on the Gulf and Atlantic coasts, closer to developed sources of material and labor and not subject to the artificially high prices of gold rush California.

In 1851 the War Department established a Board of Engineers for the Pacific Coast. This Board, which included such notable soldiers as J.K.F. Mansfield and Henry Wager Halleck, elaborated on the Joint Commission's proposals, and recommended casemates for the pair of works at the Golden Gate, and barbette batteries on Alcatraz Island. Mansfield emphasized that a state-of-the-art fort at Fort Point was "the key to the entire Pacific Coast in a military point of view."[10] Congress first appropriated funds for the construction of seacoast defenses at San Francisco Bay for fiscal year 1854, in the amount of $500,000. Work began promptly, supervised at the various sites by several junior officers who went on to distinguished military careers, such as John B. McPherson, G.W.P.C. Lee, Rene de Russy, and Zealous B. Tower.

At Fort Point, in order to begin the leveling of the *Punta de la Cantil Blanco*, Tower reported in late 1853 that "an old Spanish redan of brick which crowned the promontory has been removed."[11] At Alcatraz, the bluffs were blasted to a perpendicular face twenty-five feet high all around the island, and a beginning made on the barbette "North" and "South" batteries. Since these construction projects commenced while U.S. commerce and trade on the West Coast was in its formative stages, the difficulties the Board of Engineers had foreseen became immediately apparent. Isolation and uneven development of markets led to immense difficulties in procurement of materials, especially granite and brick. In any event, most of the brick for the projects was made on site at Fort Point, granite came from as near as Point Reyes and as far away as China, while sandstone used at Alcatraz' South Battery scarp was quarried on Angel Island.

In 1855, appropriations were increased due to the threat of war with Spain over Cuba. The barbette works on Alcatraz, being less complex and time-consuming to build than the casemated batteries at Fort Point, were given priority. The 8-inch and 10-inch columbiads at South Battery became the United States' first permanently mounted guns on the Pacific Coast. Continued construction on Alcatraz throughout the decade resulted in 1860 in a fortress "completed in a very perfect manner, to the extent of 75 guns of the heaviest caliber" ringing the island in all directions, mounted in barbette batteries, with a stout brick "defensive barracks" overlooking the island from the hill at its center.[12] Thus, all of Alcatraz Island became a fortification, and all of the works upon it took advantage of the island's hilly topography for tactical advantage. The few contemporary similarly fortified islands, such as Fort Sumter, Fort Warren, Fort Carroll and Fort Jefferson are entirely flat. They are basically merely foundations for a structure, where the topography of the island is not an integral part of the fortification and defensive fire plan, as it is on Alcatraz.[13]

Meanwhile, at Fort Point, construction continued at a slower pace because of the cost and complexity of building multi-storied tiers of arched brick casemates at a site exposed to the force of the open Pacific Ocean. By 1860, the fort had been raised to the barbette (top) tier, and had been made ready to mount ninety guns. Today, Fort Point is an excellently preserved example of a classic multi-tiered, casemated fort, belonging to the third system of American seacoast fortifications. It is the only such structure on the west coast of North America.

Both Alcatraz Island and Fort Point individually merit the status of national significance. And the contrast between the two nearby fortresses enhances their individual significance, since together they clearly demonstrate the culmination of ante-bellum military engineering in the United States. Alcatraz has already been recognized as a National Historic Landmark, while Fort Point is presently a National Historic Site.

After an inspection trip to the West Coast brought about by the Pig War filibustering of 1859 in the San Juan Islands of Washington Territory, Chief Engineer Joseph G. Totten stated of the seacoast fortifications of San

Francisco Bay that "They will compare favorably with any batteries in the world."[14] By the last day of 1859, Alcatraz had received its permanent garrison; a year later it mounted seventy-five guns. Fort Point was by then ready for as many as ninety guns to be mounted. However no action had been taken on the inner line of defenses at Angel Island and Point San Jose. A crucial omission to the Plan of 1850 was the failure of the government to acquire clear title to the lands north of the Golden Gate around Lime Point. Federal courts upheld the title of early settler William Richardson to that land, and its transfer to subsequent owner William Throckmorton, a notorious land speculator. Throckmorton's asking price was considered exorbitant. The entire Plan of 1850 was jeopardized by this failure, since "The effectiveness of Fort Point without the complimentary works across the channel was far less than even half of what it should have been with the realization of the full plan."[15] As events elsewhere swept the nation towards civil war, the seacoast defenses of San Francisco Bay stood only partially complete.

Civil War and Post-Civil War, 1861-1884

The outbreak of the Civil War and rapid technological advances of the industrial revolution put the third system fortifications to severe test. Their strategic locations placed them in the forefront of numerous crucial battles of the next four years, from the first guns at Fort Sumter, to the siege of Fort Pulaski, the running of the guns at New Orleans and Mobile Bay, and the stand at Fort Fisher. Steam propulsion, ironclad warships, and rifled cannon combined to spell *finis* to the predominance of thick masonry walls and expensive permanent fortifications in lieu of more flexible, repairable and cheaper earthworks, which, paradoxically, better absorbed the shock of repeated hammering from large-caliber smoothbore and rifled siege artillery.

As the Civil War commenced in the east with the bombardment of Fort Sumter, a third-system fort very similar to Fort Point, Lieutenant McPherson was ordered in June of 1861 to prepare a plan for defending the California coast from San Francisco as far south as Monterey. Within this historic context, it is of interest to note that Baker Beach in the Presidio of San Francisco was considered to be a "hazardous" but nonetheless possible landing spot for a hostile force. However, the basic strategy developed for the defense of San Francisco centered around a plan to contest a hostile ground force by holding a line with infantry and field artillery across the San Francisco peninsula south of the city, between Lake Merced (to be developed in the future as Fort Funston) and San Bruno Mountain. Three generations later, in early World War II, the basic approach to holding the area against potential Japanese landings had not changed.

With civil war a reality, budgetary purse-strings were loosened, resulting in increased armament on Alcatraz and the mounting of fifty-nine of the eighty-five cannon on hand at Fort Point by October 1861. These measures were taken as a reaction to Britain's augmenting the strength of their squadron at Vancouver Island and the fear of a British move to seize California while the United States was preoccupied with war in the east, rather than out of immediate fear of any Confederate naval action. George W. Wright, commanding general of the Department of the Pacific wrote in January 1862, "In case of a war with a maritime nation, the immediate attention of the enemy would most certainly be directed to this city, the great entrepot of our possessions on the Pacific coast," and in March that, "[a]lthough there are several points on the Pacific Coast that are exposed to capture by a hostile fleet, yet, in case of a war, San Francisco would first attract the enemy's attention. The loss of San Francisco and harbor involves also the loss of our navy-yard and our military arsenal at Benicia, in fact, it destroys for the time all our commerce on the Pacific. Hence this place should be made impregnable."[16]

In February 1863, the U.S. gunboat *Cyane* arrived to aid in protecting the harbor. Throughout the Civil War, the major elements of two regular army regiments, the 9th Infantry and the 3rd Artillery, were stationed at San Francisco, yet another measure of the strategic importance attached to the area.

The inner line of batteries proposed in the Plan of 1850 now began to take form, although as temporary wartime structures, rather than as permanent fortifications. On Angel Island, temporary batteries of wood and earth were constructed at Points Stewart, Knox, and Blunt, and cannon mounted at the first two sites in 1864.

At Point San Jose, the temporary structure completed that same year was of a more substantial nature, with a breast-high wall of brick, mounting six 10-inch Rodmans and six 42-pounder banded James rifles. On Angel Island, only sites presently remain where temporary batteries once stood. However at Point San Jose, now known as Fort Mason, excavation in the early 1980s uncovered the well-preserved remains of the western half of the temporary battery, which has now been restored to its Civil War appearance. This northernmost point of Fort Mason is significant as a site fortified since 1797 with four generations of coast defenses that remained active into the twentieth century.

In July 1864, Major General Irvin McDowell arrived in San Francisco to assume command of the Department of the Pacific. Although outclassed by the Confederacy's best generals on eastern battlefields, McDowell was nonetheless a professional and a veteran, and his tenure in command brought a new seriousness to California's role in the war. McDowell's arrival coincided with an increased awareness of the technical changes that wartime experience mandated, the gradually improving strategic situation east of the Mississippi, increasing domination of Mexico by France, accelerating British development of western Canada, and the perceived threat of Confederate commerce raiders (such as the C.S.S. *Shenandoah*, which had actually approached San Francisco as the war came to an end). These factors combined to cause a flurry of improvements in 1864-1865 to the harbor's defenses that included the mounting of the first 15-inch Rodmans on the West Coast at Alcatraz, a start on a bombproof casemate barracks there, and the burying of the brick scarp walls of the island's Batteries McClellan and Tower behind banks of earth.

With the end of the Civil War there came a time to assimilate the lessons learned on the battlefield and to apply them to future construction of fortifications. As formalized in 1869 by the Board of Engineers for Fortifications, the essence of those lessons was that only large rifles and 15-inch Rodman smoothbores were effective against armored vessels, that masonry works were vulnerable to such weaponry, and that earthwork barbette batteries were not only the most resistant to such fire but also the most cost-effective to build. In consequence, major changes to the seacoast defenses of San Francisco Bay were implemented in the period immediately following the Civil War, under the scheme known as the Plan of 1870. This plan reflected the new reality in seacoast fortification engineering, described thus by E.R. Lewis:

> The harbor defense construction begun after the Civil War marked the beginning of an entirely new trend in the positioning of seacoast fortifications. In contrast to the high concentrations of armament sought by designers of Third System forts, the new works were planned to be dispersed at the most tactically favorable locations permitted by terrain and the extent of the available land. In some areas new tracts were acquired for battery sites, and in certain instances these acquisitions had profound long-term effects upon regional land use. A particularly clear example is to be found in the San Francisco area..."[17]

All around Alcatraz Island, the sandstone or brick scarp walls of barbette batteries disappeared behind earth fill. Remodeling on the island soon turned into full-scale rebuilding, incorporating wider spacing between weapons, concrete earth-covered traverses separating each pair of cannon, thickened parapets, a lowering of the silhouettes of the caponiers, and a wider use of covered magazines in the counter-scarp walls of the batteries. To supplement the seventy-six mounted and eighty-nine unmounted pieces at the now technically obsolete third-system fort at Fort Point, permanent barbette batteries of earth and brick were begun on the open bluffs of the Presidio. They were named East Battery and West Battery for their position relative to the old third system fort.

In a development of major importance (both for the San Francisco fortification system and for the future of regional land use), the Lime Point Military Reservation was finally acquired in 1866, by a purchase that included all of the Marin Headlands from Point Cavallo, south of Sausalito, west to land's end at Point Bonita. At Lime Point itself, directly across the Golden Gate from Fort Point, the largest-yet, non-combat, blasting operation in the United States began, in an attempt to initiate construction for the long-awaited casemate and barbette fort complimenting Fort Point. Between 1868 and 1869, under the supervision of Major George Mendell, up to 24,000 pounds of gunpowder at a time were exploded in an effort to blast out a

level site at the base of the 300-foot cliff.[18] This rubble still exists, in part, under the northern approaches to the Golden Gate Bridge.

Although the location offered considerable tactical advantages, Lime Point was an extraordinarily difficult site for large-scale construction. Indeed, the proposed works were designed but never begun—and would have been astronomically expensive to build. As early as 1869, the New York Board of Fortifications (reviewing the recommendations of the Pacific Board) recognized the practical difficulties of the Lime Point site by declaring that simple, detached barbette batteries be built in supporting positions nearby. Thus the post-Civil War fortifications in the Lime Point area finally evolved into a water-level battery called Gravelly Beach Battery (at today's Kirby Cove) to provide grazing ricochet fire, and two barbette batteries known as Ridge and Cliff Batteries, which were situated high on the bluffs above to avoid exposure yet retain a wide field of fire. The Gravelly Beach Battery boasted the only 15-inch Rodman mounted north of the Golden Gate until 1893, when four 15-inch Rodmans salvaged from West Battery at the Presidio were remounted in Ridge Battery. [19] Ridge and neighboring Cliff Batteries, at an elevation of more than 400 feet above sea level, were the highest such structures yet built in the United States.[20]

The plan for casemated works at Lime Point was ultimately abandoned in favor of a large water battery of exceptionally handsome design at Point Cavallo, just to the east and across Horseshoe Cove. This work consisted of earthwork barbettes shaped as rough triangles, bisected by a long traverse containing magazines and bombproofs. In each half of the work were the emplacements for the now-typical pairs of 15-inch Rodmans, also separated by brick and concrete earth-covered traverses and magazines. (Three 20-inch Rodmans were proposed for the site, but never mounted; indeed, the three 8-inch converted rifles finally mounted at Cavallo Battery in 1900 were the only cannon ever emplaced there.) Cavallo Battery is the finest example of the style of earthwork fortifications representative of this era in the United States. Its builder was so proud of this completely enclosed earthwork that he even sought permission to build a sally port into it, which was, however, disapproved by his superiors as an extravagance.

The construction of this cluster of fortifications north of the Golden Gate soon led to the establishment of a new post at Horseshoe Cove, which evolved into today's handsome and well-preserved Fort Baker. These Lime Point fortifications typified in microcosm the drastic changes in seacoast fortifications over the preceding decade. "Never again would forts be built in the storybook style as single structures housing large numbers of cannon. From this time on, a fort was a piece of real estate occupied by a number of dispersed individual batteries. "[21]

The only exception of any consequence to the general state of neglect of seacoast defense between 1875 and 1890 was the continued development of submarine mine warfare. The great successes the Confederates had with such devices during the Civil War seemed to indicate that here was an effective defensive weapon that was relatively inexpensive and easy to emplace as compared with building permanent fortifications. Mines first arrived in San Francisco in 1884 and were stored in an unused casemate-style powder magazine in the 1866 defensive barracks on Alcatraz. These electrically-fired mines (or torpedoes, as they were called at the time) were intended to be sited in the inner harbor "in front of" and "in the rear of" the island.

In 1889 an appropriation was made for "Torpedoes for Harbor Defense" which allocated funds for a permanent torpedo storehouse of concrete, and for two mine casemates for the control and detonation of the mines. In 1890, as a result of that allocation, the casemate on Alcatraz was remodeled into a mine casemate (from which the mines would be electrically detonated), a storehouse was built on Yerba Buena Island, and Fort Mason became the site of the first purposefully-built mine casemate in the San Francisco Bay defenses. In 1891, a mine casemate was added at the foot of Mortar Hill on Angel Island. Additional casemates were constructed on Yellow Bluff to the north of Cavallo Battery in 1895 and at Quarry Point on Angel Island in 1897.

The harbor's mines were first planted and activated in 1898, upon the outbreak of the Spanish-American War. San Francisco was the major concentration area for the U.S. expeditionary force to the Philippines,

and the only harbor on the west coast of the United States that was protected by minefields during the war. By that time only the Fort Mason and Point Cavallo casemates were used for control of the minefields, which were located to the northeast and southwest of Alcatraz, and contained a total of sixty-three mines. At the present, the Yerba Buena torpedo storehouse, and mine casemates at Alcatraz, Fort Mason, Yellow Bluff, and Mortar Hill on Angel Island still stand, representing the first use of submarine mine warfare on the Pacific Coast.

After 1875, with the exception of underwater mine warfare, modernization came to an abrupt halt due to a number of crucial political and technical considerations. As the initial exuberance at the end of the Civil War turned to a sober realization of the war's great cost, the country's political climate changed more and more to one of isolationism. As the Indian wars raged, the Army's energies became centered on its role as a frontier constabulary, rather than as a force to be pitted against other modern military establishments. Technical developments in the field of artillery began to proceed at such a rapid pace that the building of fortifications could not, or could not afford to, keep up. Briefly summarized, these technical developments consisted of: improved casting techniques which presaged the manufacture of stronger guns in longer calibers; the continued perfection of rifling; breech-loading weapons becoming practical; better recoil systems and disappearing carriages; and higher quality, variable- burning powders becoming available. Now, artillery could theoretically be made safer to operate, easier to protect, and more deadly at ranges four times greater than ever before.

It is ironic that, when these technical advances were combined with the prevailing political climate, the practical result was that the seacoast fortifications of San Francisco Bay entered a fifteen year period of neglect in which they rapidly passed from among the nation's most formidable to being practically non-existent. This decline mirrored the nationwide trend in the state of seacoast fortifications, and indeed in the state of the nation's entire military establishment. With the exception of the battery near the Division of the Pacific headquarters at the post at Point San Jose (officially christened Fort Mason in 1884), earthwork fortifications went into ruin, and "a little rodent called the gopher (became) the worst enemy....He burrows on the parapets and destroys their shape and compactness."[22]

The works throughout the area lay in caretaker status—quiet and largely unused, until the next phase of dramatic change.

Early Modern Era, 1891-1928 (including the Endicott Period, Taft Era and World War I)

In the years immediately prior to 1890, the period of neglect for major caliber gun batteries began to draw to a close. The technical advances in artillery previously alluded to began to be synthesized with the establishment of a Gun Foundry Board in 1882. President Grover Cleveland established a special Board on Fortifications or Other Defenses in 1885 to make recommendations as to the future of the nation's seacoast defenses in light of the advances of the past fifteen years. This board soon became known as the Endicott Board, after its chairman, Secretary of War William C. Endicott.

As the frontier began to disappear and industry to increasingly prosper, America turned elsewhere for an outlet for her energies. As noted military historian Russell F. Weigley states, "merely working on the Endicott Program offered the feeling that the country now possessed a kind of military policy looking toward foreign war, and this feeling was so reassuring that in the War Department reports and the military publications of the 1890's interest in the coast defenses became almost obsessive. "[23] This feeling soon became something of a self-fulfilling prophecy with the onset of the Spanish-American War, which rapidly propelled the nation into the role of an imperial power. These interrelated influences resulted in a golden age of coast artillery, which manifested itself in many coastal areas of the United States by the rapid construction of great numbers of state-of-the-art fortifications.

The turn-of-the-century revival of seacoast fortification is a reflection of the end of the frontier, the burgeoning industrial capability of the nation, and its conscious policy of engaging the other powers of

the world in new nationalistic competition. The United States launched its new steel navy as its contribution the world-wide naval arms race of the *Dreadnought* era. A new generation of strategic thinkers espoused "a fundamental change in the relationship between the harbor defenses and the Navy, for these were the years during which the fleet was transformed from a force devoted largely to immediate continental protection into an instrument of genuine sea power" following the sea principles espoused by Alfred Thayer Mahan.[24]

> Let the port be protected by the [Army's] fortifications; the fleet must be foot-loose to search out and destroy the enemy's fleet; that is the function of the fleet; that is the only function that can justify the fleet's existence.... For the protection of our coasts we need fortifications; not merely to protect the salient points of our possessions, but we need them so that the navy can be foot-loose.[25]

In this new unified scheme of national defense, the Army fell sole heir to the mission of protecting vital naval operating bases and repair yards. The increased technical sophistication of seacoast weapon systems was acknowledged by the Army's reorganization of 1901 when separate companies of coast artillery were formed. Six years later the Army established the Coast Artillery Corps as a separate arm of the service in recognition of the importance of the specialized mission of strategic deterrence. The overseas role of the Navy in a modern defense policy was made possible by the ambitious shield of seacoast fortifications projected for the Army under the principles laid down by the Endicott Board in 1883, and now made practical by technological advances as well as by changing the changing political situation.

The Endicott Board made grandiose recommendations for twenty-two seaports on all U.S. coasts, and it gave its name to not only the type of fortifications it recommended, but also to the era in which they flourished. The board also clearly established the national significance of the structures under discussion when it ranked San Francisco second only to New York in the importance of its harbor defense, and the most important on the nation's Pacific shore. "The United States by 1900 came again to possess the most powerful coast defense system in the world."[26] In the San Francisco Bay Area, the extensive and well-preserved works of this system remain as tangible evidence of America's industrial growth, the consequent development of military technology, the era of American imperial expansion, and America's coming of age as a world power.

In order to distill the Endicott Board's sweeping plans into a practical scheme, a New York Board of Engineers convened in 1890. This board prepared a project to modernize San Francisco's seacoast defenses which, in general form, would be implemented over the next fifteen years. The most significant feature of this project was the great extension of the outer line of defenses to points well beyond the harbor entrance proper, in a reflection of the ten- to twelve-mile range of the new artillery pieces. These ranges were more or less matched by the powerful armament of modern battleships, therefore the new coast defenses were sited to engage targets as far outside the bay and its vital installations as possible. Activity thus commenced to acquire lands in San Francisco at Point Lobos and Lake Merced, south of the Golden Gate, while plans were made to construct batteries in the Point Bonita area near the outermost headlands to the north.

The general characteristics of the batteries of the Endicott era are concrete construction, partially buried behind wide parapets of earth. The cannon were mounted individually, or occasionally in pairs, and were more widely separated than before. However they had no overhead protection, for military aircraft did not yet exist. Magazines became an integral part of the battery, placed below the level of the surrounding terrain, and enclosed battery commander positions were built into the structures (Plate 10).

New construction first began to the south of the Golden Gate. At the western portion of the Presidio of San Francisco (to be constituted in 1912 as a separate coast artillery post named Fort Winfield Scott), ground was broken in 1891 for Battery Marcus Miller. Designed for three 10-inch breech-loading rifles on disappearing carriages, construction of this battery initiated the process of destruction of old West Battery above Fort Point.

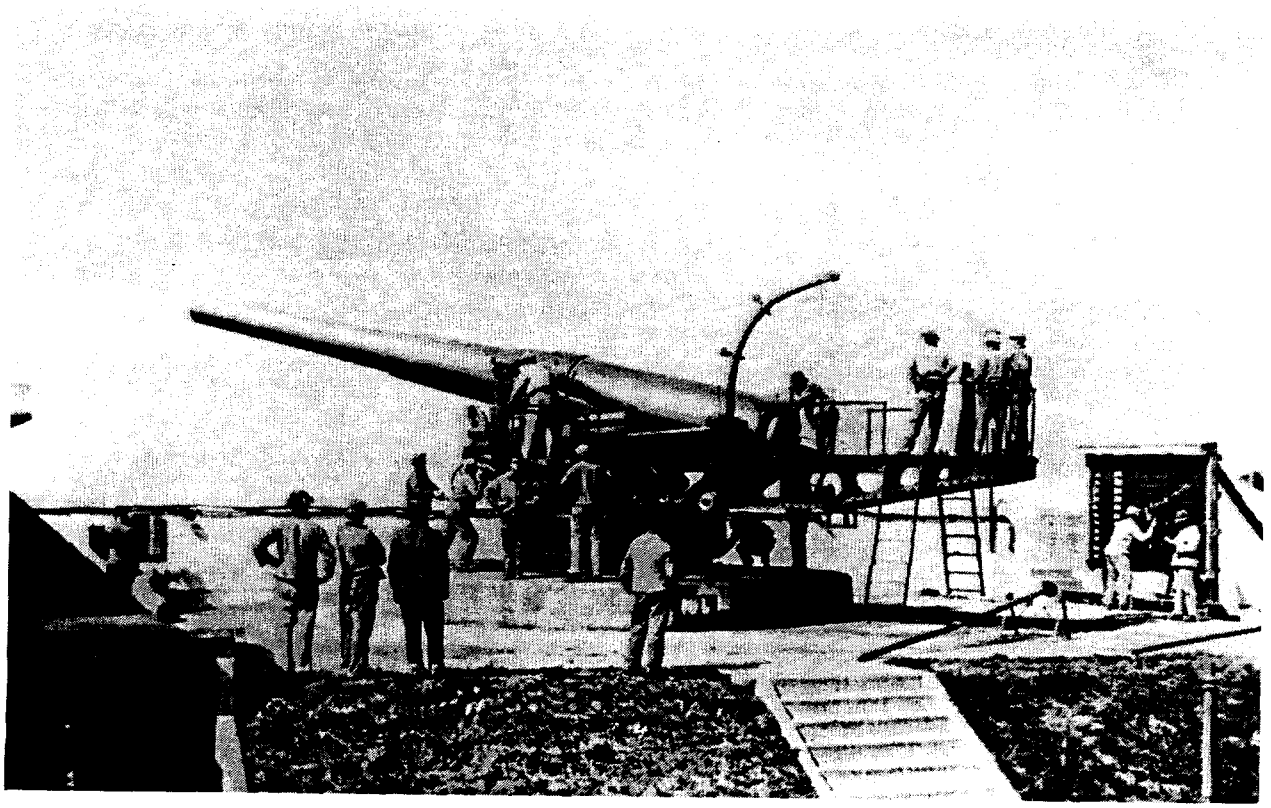

Plate 10. Battery Godfrey, Fort Winfield Scott, constructed 1892-1896. First 12-inch gun platform constructed in the United States, with the first 12-inch breech-loading rifle for the West Coast mounted in 1895. View of circa 1915. Courtesy of the Park Archives of the Golden Gate National Recreation Area.

The first modern mortar battery in the San Francisco defense system was begun in 1893, with the construction of the cross-shaped Battery Howe, designed for sixteen breech-loading mortars (12-inch). At nearby Battery Godfrey, the first 12-inch gun platform in the United States was constructed and the first 12-inch breech-loading rifle on the West Coast was mounted in 1895. Two other batteries for three 12-inch rifles, Battery Saffold and Battery Lancaster, were begun at Fort Winfield Scott during this first phase of the Endicott period.

In 1894, an experimental battery mounting three 15-inch pneumatic guns firing charges of dynamite was built between Batteries Godfrey and Saffold. This extraordinary emplacement, which included a steam plant for producing the compressed air that fires the charge, was built by the developers of the guns. It is one of only two such batteries in the United States. These weapons never proved of practical value, although they killed prodigious numbers of fish when test-fired. They were declared obsolete and sold by 1904. Battery Dynamite continued to play an important role however, even after the guns were removed. Its power house became the power unit for all of Fort Winfield Scott, and in 1919 the battery became the central fire control station for all of that fort. In World War II, Battery Dynamite was used as the harbor defense command post for the entire Bay Area.

In 1893, construction began on the first modern fortifications to the north of the Golden Gate, located on the Lime Point Military Reservation. Battery Spencer, mounting three 12-inch breech-loading rifles, was begun at the lofty site of the old Cliff Battery. Subsequent improvements to similar batteries nationwide followed an inspection of Battery Spencer by Douglas MacArthur in his role as acting chief engineer officer for the Pacific Division. Spencer was soon followed by the construction of Battery Duncan (two 8-inch breech-loading rifles) to the north of Horseshoe Cove, and Battery Kirby (two 12-inch breech-loading rifles) on the

site of old Gravelly Beach Battery. The two latter works were both unusual for their one-story design. Battery Kirby was also distinctive for its very thick parapet, and for the unusual positioning of such large weapons as water batteries.

The onset of the Spanish-American War quickened the pace of construction, and Batteries Stotsenburg (sixteen 12-inch breech-loading mortars), Cranston (two 10-inch breech-loading rifles), and Boutelle (three 5-inch rapid fire guns) were completed in quick order at Fort Winfield Scott. The latter was the first use of rapid fire guns in the area as well as the first use of the balanced pillar mount. Old emplacements at Knox Battery on Angel Island, East Battery at the Presidio, and Cavallo Battery at Lime Point were readied for the mounting of old 8-inch muzzle-loading converted rifles, of which the concrete temporary battery immediately west of the Civil War battery at Fort Mason is best-preserved. These old muzzle-loaders were a very successful reuse of the common but obsolete 10-inch Rodman smoothbore.[27] Hasty rearmament during the Spanish-American War led to some unusual contrasts in weaponry, such as at Battery Spencer, where modern rifles on the latest carriages were mounted side by side with 15-inch Rodmans of the Civil War era.

Also quickened at this time, was the pace of action on the inner line of modern heavy batteries. Although not completed until well after the close of hostilities Batteries Drew and Wallace on Angel Island (each with one 8-inch breech-loading rifle), Battery Slaughter at the Presidio east of the Golden Gate (three 8-inch breech-loading rifles), Battery Duncan at newly-constructed Fort Baker (two 8-inch breech-loading rifles), and Burnham at Fort Mason (one 8-inch breech-loading rifle) all date to this period.

In addition, because of the impetus of the war, a unified system of fire control was provided for San Francisco's harbor defenses. Such a system was developed by the Board of Regulations of Seacoast Artillery Fire in 1896, and was later instituted first in San Francisco and at Fort Monroe, Virginia, home of the Army's elite coast artillery school. This system, a considerable technological leap forward in command and control capability, was the first instance of the control of weaponry from well beyond the sights of the individual piece.

One of the results of lessons learned from the rapid rearmament of the area's defenses was the efficiency of minefields and the new rapid fire guns in protecting the inner reaches of the harbor. This realization made the 8-inch batteries of the inner line obsolete almost as soon as they were completed. Thus a series of batteries for rapid-fire guns proliferated on the shores immediately around and just inside the Golden Gate: Battery Ledyard built on Angel Island, Batteries Sherwood, Blaney and Baldwin at Fort Winfield Scott, and Batteries Orlando Wagner, and Yates at Fort Baker. Battery O'Rorke, at newly-minted Fort Barry, was located rather farther out near Point Bonita, but its mission too was to cover minefields as well as to prevent landing parties from coming ashore on nearby Rodeo Beach.

The brief emergency of the Spanish-American war over, the focus of construction turned to Marin's headlands, on the outer line of defenses to the north of the Golden Gate on the Lime Point Military Reservation, in 1897 designated Fort Baker in the east and in 1904 Fort Barry to the west. There, overlooking the northernmost headlands of the Golden Gate and the Pacific coastline stretching north, engineers completed Battery Mendell (two 12-inch breech-loading rifles) and Battery Alexander (eight 12-inch breech-loading mortars in 1901. Great difficulty was encountered in transporting heavy ordnance and equipment over the rugged hills of the headlands, and so a wharf was built at nearby Bonita Cove. Carriages for Battery Alexander's mortars fell into the sea off the wharf in 1902, but were recovered—an indication that although the engineer's wharf may have been preferable to the trip over the hills, it was not entirely without its challenges.

Meanwhile, on the San Francisco side, post-war construction on the outer line resulted in completion of Battery Chester (three 12-inch breech-loading rifles) and Livingston (sixteen 12-inch breech-loading mortars) at newly-acquired lands at Point Lobos, designated Fort Miley in 1901. Endicott era construction at San Francisco Bay culminated with Battery Chamberlin (four 6-inch breech-loading rifles) at Baker Beach, and the twin batteries (each with four 6-inch breech-loading rifles, Rathbone and Guthrie, located at Fort Barry.

The Endicott batteries of the San Francisco harbor defenses collectively compose a well-preserved and nationally-significant collection of state-of-the-art military fortifications from the turn of the century. Individual elements, and the system as a whole, embody the distinctive, specialized characteristics of military engineering at the limits of ordnance and engineering technology of the time. They are tangible symbols of events that marked the emergence of the United States as a major military power, and they have a great deal of associative significance, since they carry the names of soldiers of distinction and American military heroes in every war from the Revolutionary War onward.

The Endicott period was a great leap forward; the next important phase in the development of coast defense technology was a logical evolution to reach the full potential of the new weapons system. These developments were synthesized by the so-called Taft Board in 1905, named for President Theodore Roosevelt's Secretary of War, William Howard Taft. The mission of this board was to review and update the results of the Endicott program, and although it proposed little new in the way of major construction (at least at continental U.S. locations), the significant contribution was to accelerate the modernization of existing emplacements.

Specific modernizations of the resulting Taft era included the widespread use of searchlights organized in batteries to illuminate targets, the widespread electrification of many aspects of seacoast defense including inside lighting, telephonic communications, electrified hoists for ammunition handling, and most significantly, a modern system of indirect aiming. This method of fire control was the most significant advance in artillery fire control until the advent of radar.[28]

Indirect fire control became feasible because of simultaneous progress in optical systems, telephone communications, and mechanical devices for rapid mathematical calculation. The result was the completion by June of 1908 of over twenty-five fire control stations around the Bay Area forts. These fire control stations were used to direct groups of two or three batteries called fire commands, and relayed data on target range, bearing, course, and speed to plotting rooms at the batteries themselves. The stations were grouped in carefully surveyed base lines at high elevations with a commanding view, and also in separate low level fog bases in case of poor visibility. These structures are commonly called base-end stations because the coast artillery base lines had one such station at either end. With a complete system of such electrified base-end stations, the nation's harbor defense system would have an efficient system of integrated command and control with a previously unsurpassed accuracy of fire. The harbor defense of San Francisco became an exemplar of just such a system.

Searchlight emplacements were constructed, in locations as accessible as Fort Mason, as far-flung as Bird Rock north of Point Bonita, and at Tennessee Point, where five acres were acquired in 1914. It will be recalled that the inner line of early Endicott batteries was progressively abandoned in favor of underwater mines, with Battery Burnham at Fort Mason leading the way to oblivion in 1909 followed by those on Angel Island, and culminating with the abandonment of mortar Battery Howe-Wagner in 1920.

Mine warfare now received a great deal of attention. Many of the original mine casemates were considered unsatisfactory at the time of the Spanish-American War and more modern casemates were built at Point Bonita in 1908 and Baker Beach in 1912 to control projected off-shore fields. Between 1907 and 1910 a new mine depot was built just to the east of old Fort Point, further reflecting the decision to lay future minefields outside the Golden Gate. The location of the mine depot was not without controversy. Although Fort Point was convenient to the minefields, the storehouse site on Yerba Buena Island remained serviceable, preferable to some because it lay behind all of the harbor's defenses and was protected by them. Nevertheless, the Fort Point depot became the major facility for San Francisco's minefield defenses until just prior to World War II.

During the period of technological upgrading marking the Taft era, the structural soundness of San Francisco's fortifications was severely tested by the great earthquake in April of 1906. Although causing massive damage to buildings in the city, the fortifications required only minor repairs totaling less than

$5,000. Indeed, the most unfortunate consequence of the earthquake from the perspective of the historian was the loss of the U.S. Army Corps of Engineers' construction records, which burned in their downtown office.

Tension with Japan, a consequence of California's racist treatment of Japanese settlers and American exclusionist legislation, resulted in the construction of Battery Call (two 5-inch rapid-fire guns, no longer extant) at Fort Miley to assist in covering off-shore minefields. In spite of the fact that these two nations were to be official allies in World War I, increasing animosity was to be their mutual lot until resolved by conflict in World War II.

Although World War I had a smaller direct impact on the San Francisco Bay region than conflicts immediately before and after, certain older batteries were stripped of their armament in order to provide pieces for heavy field and railroad artillery on the Western Front, and to protect the nation's other Pacific possessions. Some years later the most significant example of this occurred, when 12-inch rifles from Battery Kirby were sent to Corregidor in 1934, and again in 1941 because of the abrogation of the Washington and London Naval Treaties.[29]

However lessons learned on European battlefields eventually had a great effect on the course of future planning for the nation's seacoast defenses, and as ever, those plans were soon put into effect at San Francisco. Britain had launched the *Queen Elizabeth* class of battleships, which mounted 15-inch rifles that outranged any of San Francisco's defenses. These powerful weapons were also able to fire at such high trajectories and great range that they could stand outside the range of the coastal batteries and bombard them with impunity, even reaching those mounted on disappearing carriages, although the higher elevation batteries and those with disappearing carriages remained relatively well-protected against short range direct fire. Many batteries, therefore, received attention in terms of extra earth and concrete protection. Although the United States continued to have color-coded plans on file for war against any of the major powers, the motivation for improving the fortifications at this time was more fear of German or Japanese warships that had followed Britain's technical lead, rather than it was of the increasingly unlikely scenario of war with Great Britain.

In reaction, the defenses of the area were extended to include construction at the Lake Merced Military Reservation (named Fort Funston in 1917). First construction on the site consisted of the very temporary Battery Bruff, two 5-inch guns, and the more permanent Battery Walter Howe (four 12-inch breech-loading mortars). The latter battery is significant because of its unusual straight line configuration (a result of the practical difficulties of having four crews working simultaneously in a four mortar pit), and because it was the very last mortar battery in service in the United States.[30]

Not surprisingly, 1915 was the year first mention was made of the need for 16-inch rifles to keep pace with battleship weaponry. Such massive pieces would obviously need to be placed at the far reaches of the defended area, and the areas at Lake Merced and Tennessee Point received attention as likely sites. As a stopgap measure, until the great rifles could be developed, a battery for two 12-inch long-range guns was built in 1919 at Point Bonita. So rapidly did the arms race continue, that Battery Wallace, with its wide spacing between guns, 360-degree traverse capability, and deep pits for high-angle firing, became for a time the only thoroughly modern emplacement in the area's seacoast defenses. Even so, its guns were not mounted until some years after the completion of the battery, and they were not test fired until 1928.

The final reflection of lessons learned from World War I was the appearance of antiaircraft defenses and the beginnings of aerial spotting of artillery fire. Batteries mounting two 3-inch antiaircraft guns were constructed at Fort Miley, Fort Winfield Scott, Fort Barry, and Fort Funston. The latter three emplacements are still extant. All further designs for seacoast fortifications were destined to take into account defensive measures against aircraft. The consequent need for dispersion resulted in a wider separation between guns, as at Battery Wallace, magazines being built farther from the emplacements, and additional camouflage

measures to avoid aerial observation.[31] (Battery Wallace was casemated after the outbreak of World War II to provide additional overhead protection.)

Large hangars for observation balloons were built at Forts Funston, Winfield Scott and Barry in 1921: of this group, the structure at Barry still remains. It was used that same year to correct the accuracy of fire from Battery Mendell, "a problem was fired, [the Army conducted a coast defense firing exercise], *for the first time in the history of the world*, in which all data was supplied from the air *by balloons*. (italics added)."[32] Use of balloons to adjust fire accurately on vessels far out at sea or hidden from land by haze or fog was soon discontinued because of high winds at the launching sites, and the vulnerability of balloons to defensive fire. It makes a short, but interesting episode: the hangar at Fort Barry is the last survivor of this type with integrity on the west coast of the United States.

Western Department Air Service Officer, and future commander of the U.S. Army Air Forces, Henry H. "Hap" Arnold, oversaw completion of Crissy Field in 1921. It was the only U.S. Army Air Service coast defense air station in the western United States, and the only survivor of this type in the nation. Located in purposeful proximity to the coast artillery command network, the primary mission of the airfield's 91st Observation Squadron and 15th Photographic Section was to locate friendly and enemy forces and to correct the fall of shot from the coast artillery batteries by visual or radio signals.

Chronology makes it fitting to introduce the construction of the Golden Gate Bridge from 1933-1937. This grand structure was the immediate cause of the burial of Batteries Slaughter and Baldwin, and the partial destruction of Battery Lancaster. In exchange, the Golden Gate Bridge District agreed to construct a new Central Reserve magazine for the Army at Fort Winfield Scott. Of greater lasting value was the effort that bridge engineer Joseph Strauss made to save old Fort Point. After extensive design work was accomplished, the northern bridge approaches were constructed in such a way as to allow the structure to vault over the fort in a great arch that emphasizes the dramatic contrast between the old and the new. With the Golden Gate, and its sister bridge across San Francisco Bay to Oakland completed, the Bay Area can be perceived as having approached the end of the Great Depression. War clouds could be dimly seen gathering on both the eastern and western horizons.

World War II Era, 1937-1948

The development of the ultimate generation of classic coast defense guns, immense 16-inch rifles, was a direct outgrowth of the greatly increased range of naval guns during and after World War I. In San Francisco, the most important continental base in any future Pacific war scenario, the need for protection from rapidly-modernizing Japanese shipboard weaponry was exacerbated by the lack of large caliber guns bearing south along Ocean Beach. A thoroughly modern battleship could thus lie off Pedro Point and leisurely shell much of the city from a range of 21,000 yards without receiving any return fire. The solution presented itself in a relatively economical way as a result of the Washington Naval Treaty of 1922.[33]

This treaty set certain limits on the size of the navies of the great powers, placed a moratorium on the further fortification of Pacific islands, and caused the abandonment of many projects already underway. The proposed *Lexington* class battlecruisers were converted to two aircraft carriers, and the 16-inch/50 caliber naval rifles already being forged for battlecruisers and battleships became available instead for coast defense. These outstanding naval weapons, with a range of 44,600 yards, became the nucleus around which future Army seacoast defense construction was planned.

As early as 1925, San Francisco was recognized as the site in the continental United States with the highest priority need for the new 16-inch rifles. (Only fortifications at the Panama Canal and in Hawaii received higher priority from the U.S. Army Corps of Engineers). Throughout the 1930s, the Army continued to update planning for harbor defense. "Concern over the developing use of aircraft and aircraft carriers caused the Army to design 16 inch batteries with substantial overhead cover. The older emplacements looked like bullseyes from the air and had no overhead protection at all. The new design enclosed the gun in a reinforced

concrete shell, similar to the old casemates of the early 1800s, but on a larger scale. Plans were also developed for 8 inch and 6 inch batteries. In (fiscal year) 1937 funds were authorized for the construction of two new 16 inch batteries at San Francisco."[34]

For a number of reasons, history was made when construction began at Fort Funston on Battery Richmond P. Davis (actually commenced in October 1936). San Francisco's harbor defenses were about to be extended to their greatest geographical extent: the huge base lines needed to get the full potential from the new rifles required five base-end stations 15,600 yards apart stretching from Pedro Point in the south to Wildcat Ridge in the north. In a wider context, Battery Davis mounted the first 16-inch guns on the Pacific Coast of the continental United States, as well as the first twentieth century use of a casemated emplacement, built as such from the ground up as a reaction to airpower. (Naturally, great pains were taken to hide the emplacements from aerial observation, even to the extent of building false roads that led away from the site.) It was thus a prototype and model for all subsequent heavy seacoast batteries built by the United States, and in some ways an example for all subsequent casemated batteries. The particular weapons mounted at Battery Davis were cast for use on the U.S.S. *Saratoga*, which went on to a distinguished career in World War II metamorphosed from battlecruiser to aircraft carrier.

To compliment the fire from Battery Davis, the Army purchased a further 800 acres in 1937 around the existing Tennessee Point Military Reservation north of the Golden Gate, and designated it Fort Cronkhite. Battery Townsley, completed there in 1940, incorporated some improvements suggested during the building of Davis. Townsley had its own reserve magazine, and an upper structure separated from its foundations in order to cushion the shock of bombs. Its base line extended 15,300 yards from Hill 640 Military Reservation in Stinson Beach south to Fort Funston. On 1 July 1940 the first 16-inch round ever fired from the West Coast left the barrels of Battery Townsley during its test-firing—and windows broke in San Francisco from the concussion. With the completion of Batteries Davis and Townsley, San Francisco can rightly be said to have had for a time the most strongly fortified harbor in the world.[35]

The timing could not have been more apt. It was, of course, motivated by increased threats of war, and developed concurrently with the deliberate sinking of the U.S. gunboat *Panay* in a Chinese river by Japanese bombers, the Spanish Civil War, and Hitler's territorial aggrandizement in Europe.

The installation of the big new rifles eventually came to be supported by numerous other technical improvements to the bay's defenses that reflected the nationwide priorities outlined by the Army's Harbor Defense Board. The defenses of San Francisco had the highest priority of any Pacific Coast area, and were systematized in the plan known as the 1937 Project for San Francisco Harbor Defenses. Highlighting the 1937 project was the concurrent development of several integrated systems. Additional batteries were called for. Concrete pads called Panama Mounts were quickly laid at Fort Funston to provide fixed firing platforms for usually mobile 155mm GPF guns sited to protect the blind spots of Battery Davis. Two additional batteries of 16-inch rifles were proposed, but only one was begun, high above the Golden Gate at an elevation over 800 feet—Battery Construction #129 became the highest heavy seacoast battery ever built. Of the 6-inch batteries proposed, Battery Construction #243 (two 6-inch rifles on shielded barbette carriages) and Battery Construction #244 (two 6-inch rifles on shielded barbette carriages) were eventually completed at Fort Miley and Milagra Ridge, respectively, and reflected the further technological advances of the 1940 modernization project.

Improved fire control was a second feature of the 1937 project. Improvements in wide base position finding allowed greater advantage to be taken of the new long range pieces, if longer base lines with more stations were established. Therefore purchases were made at Pedro Point, Mussel Rocks, Point Lobos, and Hill 640 in order to place more base-end stations. Prefabricated steel base-end stations began to replace wooden, brick and concrete structures that dated as far back as 1910. The earliest base lines only needed two base-end stations. The fire control system of the World War II era still required at least two stations for a base line, but increasingly greater ranges led to a profusion of additional stations for guns of all calibers. Coast Artillery theory dictated that the optimum length for a base line was one-third of the estimated distance to the target,

and a 16-inch battery might have as many as a dozen permanent and emergency base-end structures assigned to it. This plethora of base-end stations allowed for a vast variety of possible base lines.

Searchlights were greatly increased in number over the nine that had been emplaced prior to the 1937 project, and antiaircraft defenses were considerably strengthened. The six 3-inch antiaircraft guns mounted in pairs at Forts Funston, Winfield Scott and Barry in 1937 were augmented by additional batteries constructed at Wolf Ridge in Fort Cronkhite, and the Lincoln Park Golf Course near Fort Miley, and numerous earthwork-protected sites for .50 caliber machine guns and 40 mm automatic cannon. (Fort Miley's two antiaircraft guns were removed by the time World War II began. One weapon went to Fort Funston and one to Fort Barry to increase the number of guns at each of those batteries to three.)

A new mine depot and wharf were begun in 1937 at Fort Baker, their mission to service and maintain the north channel minefields from a location better protected than the Fort Point Depot. A supplementary storehouse on Yerba Buena Island and additional depot facilities at Fort Winfield Scott rounded out the prewar improvements to the submarine mine defenses of the Bay Area.

Improvements in tactical control thus became necessary in order to effectively manage the greatly increased flow of information to the guns, improvements that resulted in the organization of the new and old batteries into manageably-sized groupments of mutually supporting weapons with related missions. Groupment command posts were constructed at Fort Barry and Fort Funston while a command post for the entire command, designated Harbor Defenses of San Francisco, was built at the old dynamite battery at Fort Winfield Scott. It was 1940 by the time that most of these improvements had actually been started, although the underwater defenses of the area received attention somewhat earlier.

World War II came with dramatic suddenness to the United States, and it came in the Pacific rather than the Atlantic. The West Coast in particular felt the strongest fear of enemy action off its shores, due to the nature of the surprise attack on Pearl Harbor. By the end of 7 December 1941, the seacoast fortifications of San Francisco Bay were fully manned, mobile field artillery had been placed behind beaches as far north as Drake's Bay, and two battalions of the 7th U.S. Infantry Division set up beach defenses behind barbed wire obstacles at Cronkhite Beach and to the south of the Golden Gate. The tactical plan for the mobile land defense of the area had not changed much since the Civil War. In case of a landing the main line of resistance was still planned to be to the north of Mount Tamalpais and to the south of the city near Crystal Springs Reservoir. On 11 December 1941 the Western Defense Command was designated a theater of operations, with the Harbor Defenses of San Francisco as a major subordinate unit. The war gave the ultimate impetus for improved coast defense, and resulted in the culmination of the defensive system in the conventional sense.

Minefields were immediately thickened outside the harbor, eventually resulting in a 1945 total of 481 mines in thirty-seven distinct groups. A new station for the North Channel minefield was built overlooking the beach at Tennessee Cove, and a double casemate at Baker Beach was constructed to control the main and south channel minefields. Both structures are still extant. Numerous "anti-motor torpedo boat" batteries were built, mounting 90mm or 37mm antiaircraft guns and sometimes aging 3-inch guns, in rapidly traversing mounts sited to fire flat across the water at minesweepers, high-speed gunboats, or submarines attempting to run past the minefields. These temporary emplacements were named Batteries Gravelly Beach, Bonita, Cavallo, Yates, Gate, Point, Winfield Scott, Baker, Land, and Buck, their names alluding to their locations. Numerous field fortifications, often merely dugouts of concrete-filled sandbags, proliferated in tactically advantageous coastal locations, housing an observation post, a searchlight, a machine gun, or a light antiaircraft cannon.

The most important development in fire control systems since the establishment of indirect aiming principles was the perfection of radar early in the war. Soon five SCR-296A surface search radar systems were emplaced at Wildcat Ridge at Point Reyes, Hill 640 overlooking Stinson Beach, Bonita Ridge in the Marin Headlands, Devil's Slide south of Milagra Ridge, and Pillar Point near Half Moon Bay. A typical radar

station had a tower, a concrete transmitter house, and two power plants associated with it. Eventually there were nine such radar emplacements including ones at Wolf Ridge, Baker Beach, Fort Miley, and south of Fort Funston, and two SCR-682 general surveillance radars near the Point Reyes lighthouse and at Wolf Ridge in Fort Cronkhite.

In September 1942, work began at Battery Construction #129 in the Marin Headlands, and continued until November 1943, when it became obvious that such a huge fortification mounting 16-inch guns was no longer needed. The guns were brought up to the top of the hill, but never actually mounted. Even so, Battery Construction #129 made history as the most expensive fortification the United States ever built. Battery Constructions #244 and #243 were brought to completion, although weapons were not actually mounted in either until after the war.

At the start of the war, fifteen of the older Endicott period batteries had already been disarmed. By 1943, a further thirteen followed suit, the pieces salvaged for wartime scrap drives, the coast artillery units increasingly serving antiaircraft guns or being combed out for infantry replacements. By the time rapid wartime developments were assimilated in 1945, it was planned to have only twelve of the most modern 6-inch and 16-inch batteries armed after the war. But reality was to be different from plans.

The tactical and strategic lessons of World War II, especially the wartime capabilities of modern aircraft, spelt the doom of seacoast artillery fortifications in the conventional sense. Seacoast artillery entered a final stage in which it became solely a means of defending against air attack and not against ships. Amphibious warfare had been developed to such an extent during the war that beaches far removed from built-up ports were successfully used to logistically support large field formations. This enabled the fixed defenses at large seaports to be outmaneuvered, and since not all of the coastline could be effectively defended by permanent fortifications, they lost their value. The campaign in Malaya was a classic example of the outflanking of the seaward-located 15-inch guns of Singapore by a thrust against its landward side supported logistically from beaches hundreds of miles away. Airpower had assumed an importance that relegated striking fleets to the role of mobile waterborne airfields that operated well out of range of any artillery piece. It was the atomic bomb that most strikingly necessitated expansion of the concept of the outer line of defense to a distance great enough to intercept and destroy atomic bomb-armed aircraft without harm from either blast or fallout.

In 1947, all guns at the seacoast defenses of San Francisco Bay were declared surplus with the exception of the new 6-inch and 16-inch models. The very next year however, the 16-inch rifles fell to the cutter's torch and were scrapped. Four batteries of 6-inch weapons to protect the minefields were the last conventional artillery of the permanent harbor fortifications. Battery Construction #244 at Milagra Ridge Military Reservation, Pacifica, gave up its weapons last, in 1950. The now disarmed batteries lay abandoned, or were used as dormitories, storage for explosives, or air raid shelters. In 1949 the responsibility for minefield defense passed to the control of the Navy, and the Coast Artillery disappeared as a separate arm of the U.S. Army in 1950. An era had come to a close.

Cold War Era Antiaircraft Defenses, 1952-1974

When the Army Air Defense Artillery assumed the aerial defense mission of the old Coast Artillery branch, it still carried on the mission of defending the continental United States from attack from outside its shores. The threat now came entirely from aircraft, particularly those carrying nuclear weapons. Tangible manifestations of the Cold War era are reflected in the San Francisco Bay Area in terms of the continual high state of readiness maintained by local antiaircraft defenses from the Korean War through the implementation of the Strategic Arms Limitation Treaty of 1972.

Modern conventional air defense artillery up to 120mm in caliber was emplaced around San Francisco beginning in 1950 and during the Korean War, but it was the installation of the famous Nike antiaircraft missile system in sites around San Francisco Bay that marked the transition to the Cold War in a most character-defining way. The Nike-Ajax, and its successor the nuclear-capable Nike-Hercules, were used for

medium range interception of attacking aircraft formations. These radar-guided missiles could reach thirty-seven miles (Ajax) and eighty-seven miles (Hercules) and were the most widespread and longest-lived missile systems of the Cold War era.

The Nike missile system demonstrates exceptional significance due to the large numbers of weapons deployed and the extensive area they covered (300 sites and thirty states); the great expense of such a system (the most expensive missile system to date, by far); the extraordinary longevity of the system nationwide and in the Bay Area (1954-1979 nationwide and 1954-1974 in the Bay Area); and, the unusual proximity of many of these sites to the civilian population (in essence, bringing *Doctor Strangelove* to suburban backyards and to the national consciousness).[36]

Beginning in 1954, and under the command of the Sixth ARADCOM region (Army Air Defense Command), twelve permanent launch sites and associated control, housing, and command sites were constructed around the Bay Area (on San Pablo Ridge, Rocky Ridge, Lake Chabot and Coyote Hills in the East Bay; Milagra Ridge, Fort Winfield Scott and Fort Funston to the south of the Golden Gate; and Fort Cronkhite, Fort Barry, Angel Island and San Rafael to the north). The individual missile sites received target information in tactical firing situations from an Army air defense command post co-located with the U.S. Air Force at the early-warning radar station at the Mill Valley Air Force Station on Mt. Tamalpais.

After twenty years of constant readiness, the Nike missile system was declared obsolete by 1974. "Changing military technology made the use of long-range bombers unlikely in the event of modern war. The United States and the Soviet Union both developed Inter-Continental Ballistic Missiles (ICBMs) which flew at altitudes and speeds beyond which an AJAX or HERCULES could hope to reach. The NIKEs were left without targets."[37]

Most of these facilities have either been removed or altered to such an extent that they lack integrity, but the launching complex known as SF-88L at Fort Barry has been thoroughly restored and is widely recognized as the finest example of this quintessential Cold War weapon system in the nation.

Although less than fifty years old, the exceptional role of the Nike missile system in the spectrum of Cold War weaponry, and the remarkable level of integrity at Nike site SF-88L, clearly merit its consideration as integral to the proposed National Historic Landmark, especially within the context of a district with clear linkage to previous generations of weapons systems. Those missile stations located among the older fortifications are significant to the story of coast defense in the San Francisco Bay region because they demonstrate the exceptional range of the historic resources represented here. Nike site SF-88L is the last permanent fortification to defend San Francisco. "From Spanish colonial times up through the 1970s, many generations of fixed defenses were built to protect the people of the Bay Area, Site SF88L was the last link in that historic chain that extended backwards two centuries."[38]

Concluding Remarks

The seacoast fortifications of San Francisco harbor have played a significant role in the military history of the United States from the time of roundshot, black powder, and bronze cannon to the era of radar guided rockets. Throughout history, it has been the best-defended harbor on the West Coast, sometimes in the entire United States, and in some ways, the entire world. Throughout the geographic area associated with San Francisco coastal fortification history, excellently preserved examples of the evolution of military construction, engineering, and technology from 1794 to 1974 provide a veritable outdoor museum. The setting of a large part of this outdoor museum has already been chosen by Congress to be worthy of inclusion in the National Park System because of its exceptional recreational, scenic, and cultural values. The tangible fortification resources must now receive the attention and treatment they need in order to be preserved.

[1] Russell F. Weigley, *History of the United States Army* (New York: The Macmillan Company, 1967), 284.
[2] Emanuel Raymond Lewis, *Seacoast Fortifications of the United States: An Introductory History* (Missoula, Montana: Pictorial Histories Publishing Company, 1990), 4.
[3] As quoted in Colonel Eben Eveleth Winslow, *Notes on Seacoast Fortification Construction,* Occasional Papers, Engineer School, United States Army, No. 61 (Washington, D.C.: Government Printing Office, 1920), 12.
[4] Dale E. Floyd, *Defending America's Coasts, 1775-1950: A Bibliography* (Alexandria, Virginia: U.S. Army Corps of Engineers, 1997), xi.
[5] Emanuel Raymond Lewis, *A History of San Francisco Harbor Defense Installations: Forts Baker, Barry, Cronkhite, and Funston* (Corvallis: Oregon State University, 1965), 165.
[6] Erwin N. Thompson, *Historic Resource Study Seacoast Fortifications of San Francisco Harbor Golden Gate National Recreation Area California* (Denver: U.S. Department of the Interior, National Park Service, 1979), 1.
[7] Lewis, *Seacoast Fortifications,* 42.
[8] *Ibid*, 45.
[9] As quoted in *Ibid*, 21. 1 and 29 August 1849 and 31 March 1850, Letters Received 1838-1866, Office of the Chief of Engineers, RG 77, National Archives Record Center, San Bruno.
[10] *Ibid*, 28.
[11] *Ibid*, 31.
[12] *Ibid*, 45.
[13] *Ibid,* 54, 90.
[14] Thompson, 45. Chief Engineer Joseph G. Totten to Secretary of War Floyd, 9 November 1859, Office of the Chief of Engineers, RG 77, National Archives Record Center, San Bruno.
[15] Lewis, *Forts Baker, Barry, Cronkhite and Funston*, 34.
[16] As quoted in Benjamin Franklin Gilbert, "San Francisco Harbor Defense During the Civil War," *California Historical Society Quarterly,* 33 (September 1954). Original citing, Wright to Governor Leland Stanford and Wright to General Lorenzo Thomas.
[17] Lewis, *Seacoast Fortifications*, 72.
[18] Thompson, 77-80.
[19] *Ibid,* 103.
[20] *Ibid,* 93.
[21] Lewis, *Seacoast Fortifications,* 70.
[22] As quoted in Thompson, 118.
[23] Weigley, 284.
[24] Lewis, *Seacoast Fortifications*, 98.
[25] *Ibid,* 99.
[26] *Ibid,* 119.
[27] *Ibid,* 124.
[28] *Ibid,* 93.
[29] *Ibid*, 238.
[30] Lewis, *A History of San Francisco Harbor Defense,* 213.
[31] Lewis, *Seacoast Fortifications*, 221.
[32] Thompson, 287, and *Air Service News Letter,* 29 December 1920.
[33] See Edward S. Miller, *War Plan Orange* (Washington: Naval Institute Press, 1991) for an excellent discussion of United States planning for war with Japan at the highest strategic level, beginning in 1904, and San Francisco's role both as a base and as a part of a hemisphere-wide defense network..
[34] Mark Berhow, "America's Last Seacoast Defenses: The World War II-Era Construction Program," *Coast Defense Study Group Journal* 8:3 (August 1994), 33.
[35] Lewis, *Seacoast Fortifications,* 251.

[36] Michael Binder, notes from a presentation entitled "Cultural Resource Management and Cleanup of Nike Missile Sites," presented at the Annual Conference of the National Council on Public History, Sacramento, California, March 1994.

[37] John A. Martini, *Nike Missile Site SF88L (Fort Barry): Self-Guided Tour, Golden Gate National Recreation Area* (San Francisco: U.S. Department of the Interior, National Park Service, 1987), 7.

[38] *Ibid*, 7.